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WITH DIFFERENT PROBABILITIES OF OCCURRENCE,
IN A CLEARED MOUNTAINOUS ZONE OF THE ROMANIAN CARPATHIANS

by

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MAXIMUM WIND VELOCITY, WITH DIFFERENT PROBABILITIES OF OCCURRENCE, IN A CLEARED MOUNTAINOUS ZONE OF THE ROMANIAN CARPATHIANS

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The wind is an external factor which exercises very important mechanical stresses on constructions, stresses generated by the force of gravity and its pulsational nature.

In mountainous regions, it is a nearly permanent element in a set of meteorological factors, attaining, in the advective phase, especially high velocities which put high metal structures in danger (television antennas, supporting poles for high-tension electrical or cable car lines, etc.).

The safety of the structures calls for planning them with a calculation parameter being resistance to maximum wind velocities with different probabilities of occurrence. These limiting values have, for a period of years, been difficult to establish by direct measurement, due to the lack of a sufficiently long period of recording or an adequate measuring instrument. Thus, up until 1964, a weather vane with a vertical plate was used at meteorolog-

ical stations for determining wind speed, with which it is not possible to measure wind velocities which exceed 20 m/sec. Only in that year was a weather vane installed with a heavy plate, and with the aid of which it was possible to obtain wind-speed indications of up to 40 m/sec.

According to the procedure for carrying out the observations, data on wind velocity are averaged for a time period of two minutes. Therefore, the maximum velocity obtained on the basis of these values is averaged for the same time interval. In this work, the maximum velocity will thus be understood to be the maximum velocity averaged for two minutes.

In addition, because the maximum velocity cannot be selected from certain measured values, it must be deduced, as a probable value, through the statistical processing of a number of values. The calculation method consists of extending into a zone of probable velocities the certainty curve obtained for the measured values.

The same method is used in the present work in calculating maximum velocities greater than 40 m/sec on the basis of values for maximum daily velocities, measured with the aid of a weather vane with a heavy plate, in the period of 1964-1972, at meteorological stations in a mountain zone.

The maximum daily velocity has been selected as the largest value of the data obtained by measurements carried out in the hours of meteorological and

synoptic observation and with warning.

The operating procedure consisted of:

- constructing the necessary probability diagrams;

- calculating and drawing on the diagrams the cer-curves for values provided from the measurements;

extending the curves into the zone of high velocities (over 40 m/sec) and extracting the maximum velocities from this zone with different probabilities of occurrence.

The working diagram used (Fig. 1) was constructed on a double logarithmic scale, after the model conceived by L. Ye. Anapolskaya [1], and it contains:

- along the ordinate, on a double logarithmic scale, the cumulative frequency (Fv) of winds, in % of the total number of cases; all along the diagram ordinate, a scale is given for the probability of occurrence for maximum wind velocities, given for a certain interval of time, expressed in years, in a zone of high velocities;

- along the abscissa, on a logarithmic scale, is wind velocity in m/sec.

In order to obtain the certainty curves, cumulative frequencies were determined and the certainty was calculated along the velocity thresholds from meter to meter. The curve, in the system of ruled

lines used, is reduced to a straight line. By extending this straight line into the zone of velocities greater than 40 m/sec, maximum velocities are obtained with different probabilities of occurrence at the altitude of the meteorological stations used, as is seen from Table 1.

Then, the graph was drawn for variations in the maximum probable velocities in relation to altitude (Fig. 2).

Keeping in mind the fact that only meteorological stations were used which fulfilled the condition of obstacles being completely cleared away, the calculated values characterize high areas on mountain summits and their peaks.

Some of the results obtained by recent instrument recordings attest to the possibility of similar especially high wind velocities occurring in high mountain regions. Thus, at the Meteorological Observatory in the Tatra mountains in the Polish People's Republic, at an altitude of about 2000 m, maximum velocities of 65 m/sec were recorded in the month of August, 1967 and 80 m/sec in May, 1968, with an anemograph of the M-27 type, in the first year of its operation.

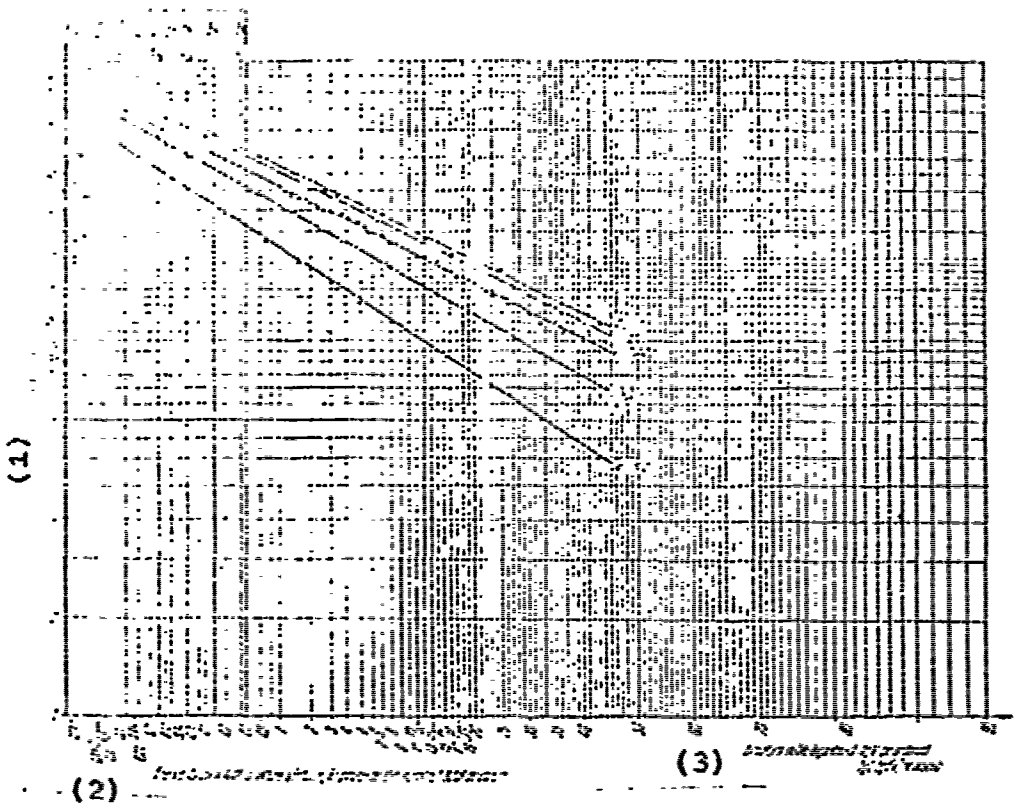

Fig. 1. Diagram for determining maximum wind velocities by the method of statistical extrapolation.
Key: (1) Wind velocity, m/sec; (2) Cumulative frequency of wind velocity, in percentage of total number of cases; (3) Double logarithmic ruling: log V along the ordinate, log(-log fv) along the abscissa.

Table 1. Maximum values, averaged for two minutes, for wind velocities with different probabilities of occurrence, deduced by the method of statistical extrapolation.

(1)	(2)	(3)	(4) Probabilities de prédiction:						(5)
№ п.	Пункт метеонаблюдений	Altitude en mètres	1/1	1/2	1/5	1/10	1/20	1/50	1/100 ans
1	Vf. Omu	2 [illegible]	53	58	61	67	71	76	80
2	Țarcu	2 150	52	57	62	65	69	74	78
3	Vladeasa	1 828	47	51	56	59	62	66	70
4	Lăcauți	1 777	42	47	51	54	57	62	65
5	Semenic	1 435	32	36	40	43	46	50	53

Key: (1) Meas. no.; (2) Meteorological station; (3) Altitude; (4) Probability of occurrence: ; (5) yr.

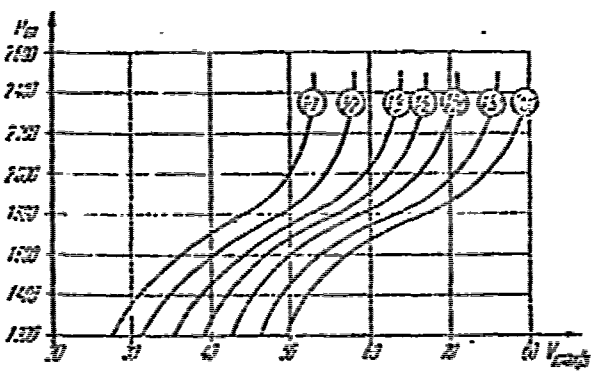

Fig. 2. Variation in relation to altitude for maximum values (averaged over two minutes) of wind velocities with different probabilities of occurrence.

LITERATURE

1. Anapolskaya, L. Ye. and Gandin, L.S. "Procedure for Determining Calculated Wind Velocities for Projecting Wind Stresses on Structures." Meteorologiya i gidrologiya, No.10, 1958.

2. Böer, W. Technische meteorologie Technical Meteorology . Leipzig, B. G. Teubner Verlagsgesellschaft, 1964.

3. Tistea, D., Lorentz, R., and Bizic, G. "Application of the Statistical Extrapolation Method to the Determination of Maximum Averaged Wind Velocities as a Calculation Parameter in Construction Planning." Culegere de lucrari de climatologie aplicata, I.M.H., Bucharest, 1972.

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